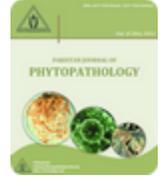




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**SURVEY OF CHILLI ANTHRACNOSE; POTENTIAL THREAT TO CHILLI CROPS
A FOCUS ON PUNJAB, PAKISTAN**

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ABSTRACT

Chilli anthracnose is widely distributed and economically important disease which affects the crop at pre and post-harvest crop stages. Disease is caused by *Colletotrichum capsici* and *C. gloeosporoides* which produce small, circular black spots with concentric rings of acervuli on fruit skin which turn the fruit black. Field survey was conducted in five major chilli growing districts of Punjab province viz., Rawalpindi, Kasur, Vehari, Okara, Multan and Bahawal Nagar to access the disease incidence and severity. The study revealed variations in mean disease incidence and severity levels in the five visited districts. The mean disease incidence was highest in Kasur district (85.1%) followed by 81.83% in Vehari district. Of the five districts, minimum mean disease incidence was observed in Rawalpindi district (37%). The maximum disease severity (74.6%), measured in terms of fruit area infected from Kasur district followed by 72.83% from Vehari district and minimum severity was observed 35% in Rawalpindi district. It reveals predominance presence of the anthracnose disease as a major constraint to chilli cultivation.

Keywords: *Colletotrichum capsici*, *Capsicum annum*, chilli anthracnose, disease severity, disease incidence.

INTRODUCTION

Chilli (*Capsicum annum*) is one of the major crops, cultivated in tropical and subtropical domains of the world. It belongs to *Solanaceae* family (Hussain and Abid, 2011) and is considered valuable cash crop around the world and also in Pakistan. In Pakistan during 2013, area under pepper chilli cultivation was 66500 ha with a total production of 23077 tons (FAO, 2013). Several biotic and abiotic factors affect the productivity of the chilli pepper crop worldwide. Among the biotic factors, numerous fungal, bacterial, nematodes and virus result into devastating diseases which deteriorate the quality and quantity of the produce and are often difficult to control (Nono-womdim, 2001).

Chilli anthracnose caused by *Colletotrichum capsici* is a major problem in chilli pepper production which infects the ripened fruits and result into fruit rot, occur frequently around the world in chilli growing areas (Poulos, 1992). Attack of *Colletotrichum capsici* results up to 50% fruit yield loss (Pakdeevaporn *et al.*, 2005). Typical anthracnose symptoms on chilli fruit include

sunken necrotic tissues with concentric rings of acervuli and fruit blemishes which reduced the market value (Manandhar *et al.*, 1995).

Extensive work has been carried out on this disease in various countries of the world but in Pakistan, no work has been done to document the exact picture of the anthracnose disease especially in Punjab region. Current study was designed to investigate the disease incidence and severity of chilli anthracnose by conducting extensive survey and this report will help other researchers to develop integrated strategic approach to manage the disease in future to avoid yield losses due to Chilli anthracnose.

MATERIALS AND METHODS

Comprehensive field survey was conducted in five major chilli growing districts viz., Rawalpindi, Kasur, Vehari, Okara, Multan and Bahawal Nagar in Punjab province Pakistan between May - July 2014 to estimate the Anthracnose disease incidences and severity. Chilli crop is majorly cultivated in selected visited districts (Hussain and Abid, 2011). Six locations were randomly selected for disease incidences and severity level observations and from each location 30 plants were randomly subjected to observation. Percentage disease index from each location

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was calculated by the following formula:

$$\text{Percentage Disease Index} = \frac{\text{No. of infected fruit samples}}{\text{Total No. of fruits per plant}} \times 100$$

Variation in disease incidences and severity level among the visited locations and districts was also made to understand the disease occurrence. Disease severity was estimated by considering whole fruit area 100% and infected fruit area was determined by taking visual observation as reported by (Hossain *et al.*, 2010).

Statistical Analysis

Collected data was arranged in Microsoft Excel 2010 version and mean disease incidence and mean disease severity values were calculated by applying built in formulas. Euclidean distances were utilized to perform Hierarchical Cluster analysis to build Dendrograms (using average linkages) between the groups. Arithmetic averaged values both for disease incidences and severity were utilized to perform cluster analysis by using SPSS version 16.0.

RESULTS AND DISCUSSIONS

Anthracoze lesions starts to appear on green fruit to reach the red ripen stage (Rajapakse & Ranasinghe, 2002). Data on disease incidence was taken from each visited locations in each district by considering the infected fruits to the total number of fruits per plant basis. From various locations visited in Rawalpindi, maximum disease incidence was recorded 52% from Taxila followed by 50 and 40% from Gujjar Khan and Kahuta respectively while minimum incidence 20% was recorded from Murree. Disease severity was recorded between 5 and 60% and maximum severity 60% was recorded from Kahuta while minimum was observed from Murree as given in Table 1. From Vehari district, Maximum disease incidence was recorded 88% from Burewala (Chak158B) followed by 84% from Vehari (Chak 155) and 82% from Burewala (Chak267B) while disease severity was recorded 90% from Mailsi (Khan Pur) and minimum severity was observed 60% from Vehari (Chak 155) as given in Table 2. From all the locations visited in Okara district, disease incidence was recorded very high ranged from 70 to 89%. While the highest disease severity was recorded 88% from Renala Khurd East (Chak No 11/1.A.L) followed by 79% from Renala Khurd West (Chak No 14/1R) and 70% from Okara East (Lakhoti) while minimum severity 50% was observed in Depalpur East (Dhola Mustkeem) and Okara West (Noor Shah) as given in Table 3.

Highest disease incidence 99% was recorded from Kot Radha Kishan in Kasur district followed by 88% from Kasur East (Nathu Wala), 83% from Pattoki and 82%

from Kasur West (Baba Jhanda). Data recorded on disease severity indicates that severity level was above 70% in all the visited areas and maximum severity was recorded upto 80% from fields in Raiwind (Kasur) as given in Table 4. From Bahawal Nagar district, maximum disease incidence 82% was recorded from Minchinabad followed by 80% from Bahawal Nagar East (Laleka) and 78% from Bahawal Nagar West (Dogran Wala) while minimum disease incidence 55% was recorded from Haroonabad. Disease severity was recorded high in almost all the visited areas as maximum disease severity 75% was recorded from Bahawal Nagar West (Dogran Wala) and minimum severity was recorded 56% from Chistian and Fort Abbas as given in Table 5.

District level comparison on mean disease incidence and mean severity level indicates that maximum mean disease incidence 85.1% was recorded from Kasur district followed by 81.81%, 71.3% from Vehari and Bahawal Nagar while minimum mean incidence of 37% was recorded from Rawalpindi district. Mean disease severity level was recorded maximum 74.6% and 72.83% from Kasur and Vehari while minimum disease severity 35% was recorded from Rawalpindi district as shown in Figure 1.

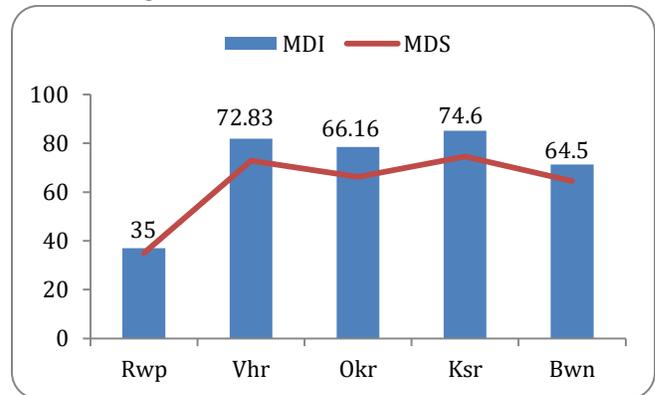


Figure 1. Comparison of Mean diseases incidences and severity levels in various districts in Punjab against Chilli anthracnose.

MDI = Mean disease incidence, MDS = Mean disease severity, Rwp = Rawalpindi, Vhr = Vehari, Okr = Okara, Ksr = Kasur, Bwn = Bahawal Nagar.

It is clear from the dendrogram that is based on mean disease incidence indicates that two main clusters were formed as shown in figure 2. Cluster - 1 consisted of various sub-clusters and as a whole consists of 21 locations where disease incidences are above 65% and maximum disease incidence 99% recorded from Kot Radha Kishan.

Table 1. Percentage disease incidence and severity of chilli Anthracnose at various locations in district Rawalpindi.

Location	Total No. of Plants	No. of Fruits	No. of infected fruits	% Disease Incidence	% Disease Severity
Rawalpindi	30	1300	390	30	10
Murree	30	1000	200	20	5
Gujjar khan	30	1400	700	50	55
Taxila	30	1500	780	52	40
Kahuta	30	1000	400	40	60
Kotlisatian	30	1200	360	30	40
Total	180	7400	2830	37%	35%

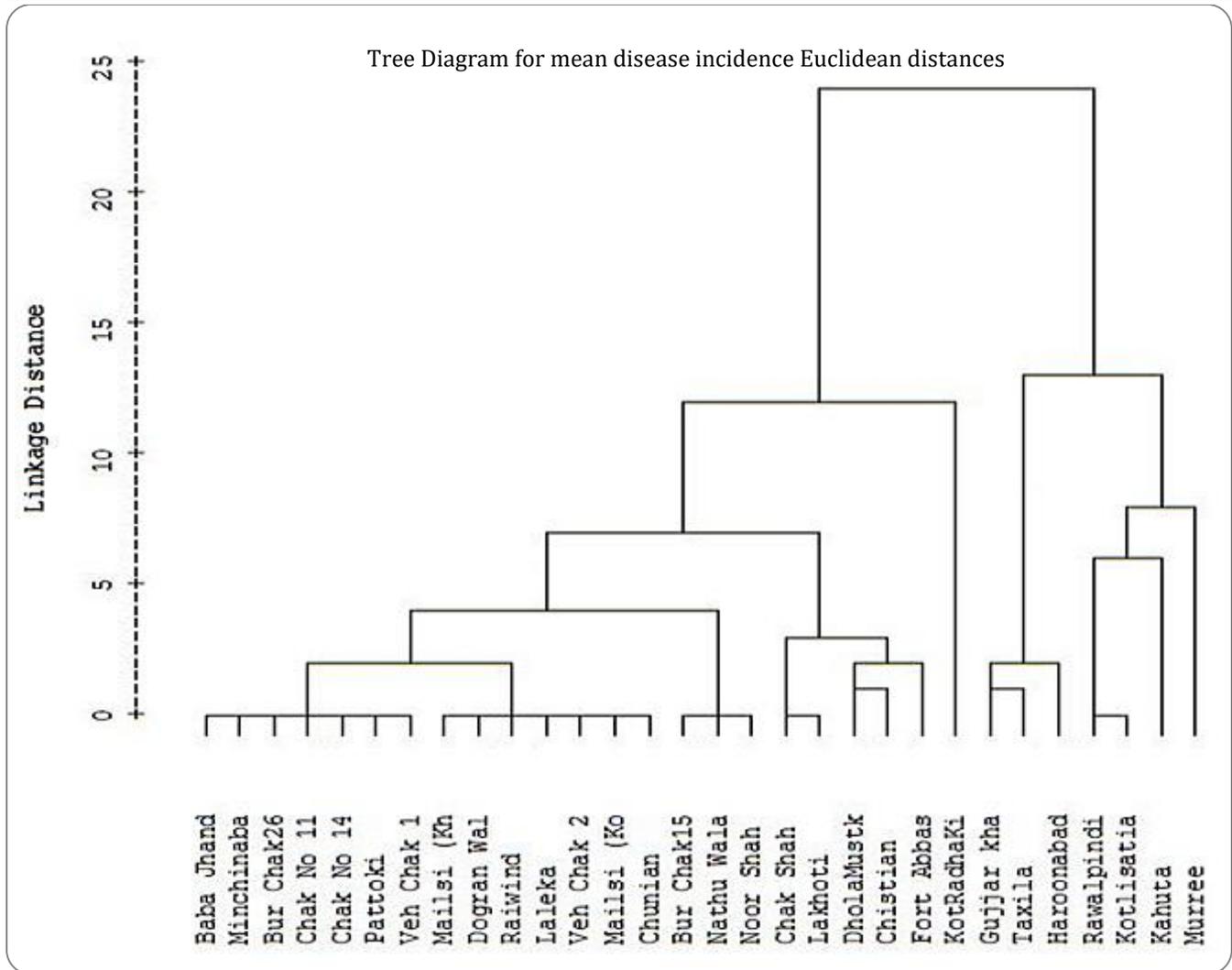


Figure 2. Clusters of dendrogram based on mean disease incidence of chilli anthracnose recorded from 30 locations of five districts in Province Punjab.

Cluster - 2 consists of 07 subdivisions viz., Gujjar Khan, Taxila, Haroonabad, Rawalpindi, Kotlisatian, Kahuta and Murree where disease incidences ranging from 20% to 50%. From dendrogram that is based on mean disease severity indicate that two main clusters were formed as shown in figure 2. Cluster - 1 consisted of sub-clusters

and comprises of 28 locations where disease severity ranging from 40% in Taxila to 90% in Mailsi (Khan Pur) while cluster - 2 consists of 02 subdivisions viz., Murree and Rawalpindi where disease severity is 5%, to 10% respectively.

Table 2. Percentage disease incidence and severity of chilli Anthracnose at various locations in district Vehari.

Location	Total No. of Plants	No. of Fruits	No. of fruits infected	% Disease Incidence	% Disease Severity
Vehari (Chak 23)	30	1500	1200	80	70
Vehari (Chak 155)	30	1450	1218	84	60
Mailsi (Khan Pur)	30	1245	971	78	90
Mailsi (Kot Haru)	30	1234	975	79	80
Burewala (Chak 158B)	30	1200	1056	88	67
Burewala (Chak 267B)	30	1245	1020	82	70
Total	180	7874	6400	81.83%	72.83%

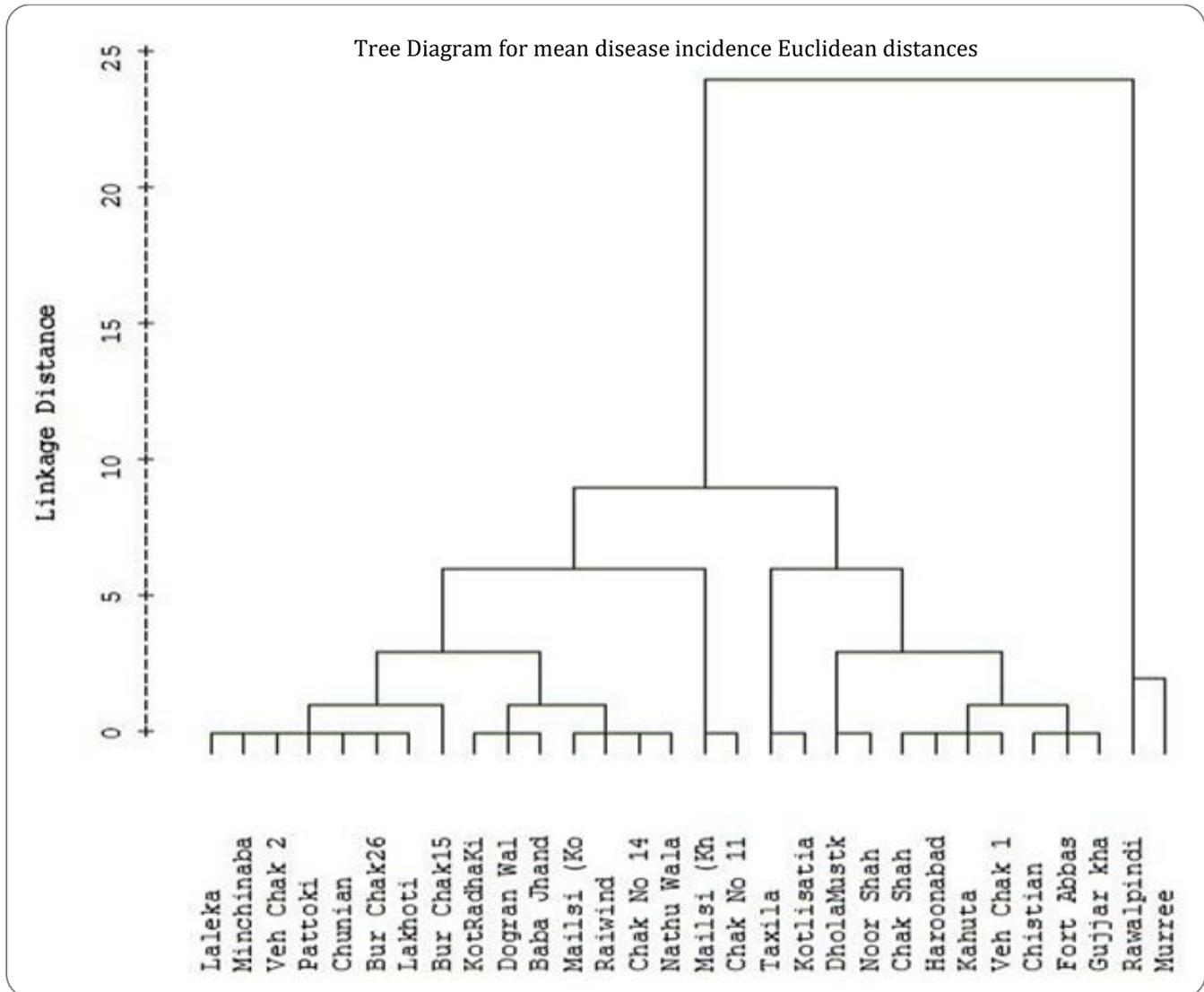


Figure 3. Clusters of dendrogram based on mean disease severity of chilli anthracnose recorded from 30 locations of five districts in Province Punjab.

Severe disease incidence may be attributed due high mean temperature in Kasur and Vehari during May-June i-e 39°C to 40°C and 40°C to 44°C respectively while the least disease incidence (37%) was recorded in Rawalpindi

district during the survey season. This lower incidence level in Rawalpindi district may correlate to low average temperature during the same growing season as of May-June i-e 27°C to 32°C. Incidence and severity of the

disease results in crop yield reduction as Sastry and Hegde (1989) stated that the amount of crop and fruit losses to a particular disease varied from place to place because of the existence of different races, biotypes, or strains of the pathogen. Rainfall influenced the disease

development depending on the amount, duration, intensity and pattern of rainfall during a crop cycle. The spread of the disease in the field was also greatly influenced by the direction of prevailing winds, indicating the importance of wind-borne spores for disease spread.

Table 3. Percentage disease incidence and severity of chilli Anthracnose at various locations in district Okara.

Location	Total No. of Plants	No. of Fruits	No. of fruits infected	% Disease Incidence	% Disease Severity
DholaMustkeem	30	1600	1120	70	50
Chak Shah M.Bodla	30	1234	913	74	60
Okara East (Lakhoti)	30	1300	949	73	70
OkaraWest (Noor Shah)	30	1323	1178	89	50
Chak No 11/1.A.L	30	900	164	82	88
Chak No 14/1R	30	1223	1015	83	79
Total	180	7580	5339	78.5 %	66.16%

Table 4. Percentage disease incidence and severity of chilli Anthracnose at various locations in district Kasur.

Location	Total No. of Plants	No. of Fruits	No. of fruits infected	% Disease Incidence	% Disease Severity
Nathu Wala	30	1400	1232	88	78
Baba Jhanda	30	1245	1020	82	75
Pattoki	30	1256	1042	83	70
Chunian	30	1300	1027	79	70
KotRadhaKishan	30	1200	1188	99	75
Raiwind	30	1300	1040	80	80
Total	180	7701	6549	85.1%	74.6%

Table 5. Percentage disease incidence and severity of chilli Anthracnose at various locations in district Bahawal Nagar.

Location	Total No. of Plants	No. of Fruits	No. of fruits infected	% Disease Incidence	% Disease Severity
Laleka	30	1500	1200	80	70
Dogran Wala	30	1400	1092	78	75
Chistian	30	1250	850	68	56
Fort Abbas	30	1255	816	65	56
Haroonabad	30	1266	696	55	60
Minchinabad	30	1300	1066	82	70
Total	180	7971	5720	71.3%	64.5%

The mono cropping pattern along with strong winds in the surveyed areas of Kasur and Vehari may also attribute to the higher inoculum buildup of pathogen in the soil as well as its dispersal among healthy fields.

Punjab has versatile geographical regions ranging from hot deserts of Bahawal Nagar to cool mountains of Murree hills which may favors or restricts the spread of pathogens in the province causing different diseases. Environmental condition of high humidity and moderate temperature may resulted in increased fruit rot (anthracnose) as the climatic condition suit the growth and reproduction of *Colletotrichum capsici*. The

association amongst temperature variation, rainfall intensity, surveying time, cropping pattern and the dispersal of inoculum are potential reasons for different levels of disease severity (Dodd *et al.*, 1992). While in our study it was observed that high temperature along with random rainfalls during the growing season led to the high incidence level in Kasur and Vehari. Temperature often interacts with other factors, such as leaf surface wetness, humidity, light or competitive micro biota (Royle and Butler, 1986). The duration of the surface wetness, however, appears to have the most direct influence on the germination, infection and

growth of the pathogen on the host. Generally infection occurred during warmer environment, higher relative humidity. Temperatures around 27 °C to 32 °C and high humidity are optimum environmental factors for anthracnose development (Roberts *et al.*, 2001).

Most of the subsistent farmers have cultivated this crop on the basis of generating little income to sustain their livelihood especially in Vehari and Okara districts. It is therefore obvious that severity of the disease can be reduced by using alternate integrated disease management friendly to the environment. The presence of anthracnose is an on-going dilemma at small scale farmers of the Punjab probably due to improper attention paid to the farmer's community by government to manage this disease and abrupt change in weather conditions.

REFERENCES

- Dodd, J.C., A. Estrada and M.J. Jeger.1992. Epidemiology of *Colletotrichum Gloeosporioides* in the Tropics. In: Bailey JA, Jeger MJ, editors. *Colletotrichum: Biology, Pathology and Control*. Wallingford: CAB International. pp. 308–325.
- FAOSTAT, 2013.<http://faostat3.fao.org/download/Q/QC/E>.
- Hossain, T.M., S.M.M. Hossain, M.A. Bakr, K. M. MatiarRahman and S.N. Uddin.2011. Survey On Major Diseases Of Vegetable And Fruit Crops In Chittagong Region, Bangladesh J. Agril. Res. 35(3): 423-429, September 2010
- Hussain, F. and M. Abid.2011. Pest and diseases of chilli crop in Pakistan: A review. *Int. J. Biol. Biotech.*, 8: 325-332.
- Manandhar, J.B., G.L. Hartman and T.C. Wang.1995. Anthracnose development on pepper fruits inoculated with *Colletotrichumgloeosporioides*. Pl. Dis. 79: 380-383.
- Nayaka, S.C. Chandra, A.C. Shankar, S.R. Niranjana, H.S. Prakash and C.N. Montensen. 2009. Anthracnose Disease of Chilli Pepper. Technica Bulletin 15pp.
- Nono-womdim, R. 2001.An overview of major virus diseases of vegetable crops in Africa and some aspects of their control. In: *Proceedings of Plant Virology in sub Saharan Africa*, 4-8 June 2001 IITA, Nigeria, pp 213-230.
- Pakdeevaram, P., S. Wasees, P.W. Taylor and O. Mongkoloporn. 2005. Inheritance of resistance to anthracnose caused by *colletotrichumcapsiciincapsicum annum*. Pl. Breed. 124: 206-208.
- Poulos, J.M.. 1992. Problems and progress of chilli pepper production in the tropics. In: C.B Hock, L.W Hong, M Rejab, A.R Syed, (eds). *Proceedings of the conference on chilli pepper production in the tropics*. Malaysia: Kuala Lumpur; pp. 98–129.
- Rajapakse R. G. A. S. and J.A.D.A.R. Ranasinghe. 2002. Development of variety screening method for anthracnose disease of chilli (*Capsicum annum* L.) under field conditions. *Tropical Agriculture Research and Extension* 5 (1&2).
- Roberts P.D., K. Pernezny and T.A. Kucharek. 2001. Anthracnose caused by *Colletotrichum* sp. on pepper. *Journal of University of Florida/Institute of Food and Agricultural Sciences*. (Available from:<http://edis.ifas.ufl.edu/PP104>).
- Royle D.J and D.R. Butler.1986.Epidemiological Significance of Liquid Water in Crop Canopies and its Role in Disease Forecasting. In: Ayres PG, Boddy L, editors. *Water, Fungi and Plants*. Cambridge: Cambridge University Press; 1986. pp. 139–156.
- Sastry, M. N. L. and R. K. Hegde. 1989. Variability of *Phytophthora* species obtained from plantation of Karnataka. *Indian Phytopath.*42(3): 421-425. <http://www.agricorner.com/present-status-and-prospects-of-chillies-in-pakistan/> <http://namc.pmd.gov.pk/>.